Electrical standardisation in relation with the directive 94/9/CE

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ELECTRICAL STANDARDISATION IN RELATION WITH THE DIRECTIVE 94/9/EC

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I INTRODUCTION

At the beginning of this century, electrification of coal mines was more or less developed in industrial European countries. In order to avoid catastrophic fire damp explosions the different national authorities set up rules and technical provisions for the construction and testing of electrical equipment for the coal mines. Each country has its own rules, often with significant differences.

With the technical progress and the Rome treaty, the members states of the European Economic Community have felt the need to harmonise their national regulations in order to facilitate commercial exchanges.
This task was given in 1968 to the European committee for the co-ordination of electrotechnical standards (CENELCOM). The technical committee TC 31 started this work based on different national standards and regulations.

Enlarged in 1972 due to the entry of new members in the European Community and those of EFTA, CENELCOM became, the 1st of January 1973, CENELEC.

The 1st of March 1977, CENELEC adopted seven standards for electrical apparatus for use in potentially explosive atmospheres.

Following the Directive 76/117/EEC, the Directive 79/196/EEC introduced these standards as harmonised standards. This directive defined also the distinctive European mark Ⓔx.

These directives and standards have represented a positive development in the prevention of explosions and they have contributed to the removal of trade barriers for explosion protected electrical apparatus.

The experiences have led to the creation of 'New Approach Directives'. In the field of equipment for potentially explosive atmospheres, the Directive 94/9/EC (called ATEX directive) succeeds the old directives.

The ATEX directive applies to all potentially explosive atmospheres caused by gas and dust and applies to all equipment, not only for the electrical one.
It defines rules for the safety and the health of persons, domestic animals and property concerned by the use of equipment in potentially explosive atmospheres. It allows also different ways to prove the conformity.

II MANDATED EUROPEAN STANDARDS

A major advantage of the Directive 94/9/EC is the system of presumption of conformity given by using harmonised European standards. The detailed technical specifications in the harmonised standards correspond to the rules of safety of the directive. Although not compulsory, they have the advantage of presumption of conformity. Only standards mandated by the European Commission give this presumption.

To optimise the ATEX directive and to give a help to manufacturers, the European Commission gave a mandate to CEN/CENELEC to produce such harmonised standards. This mandate requires an intensive co-operation between CEN and CENELEC to do the following work:

1- To review and, where necessary, modify existing standards in order to align them with the essential safety requirements of the directive,
2- To establish the new required standards, giving priority to horizontal standards, which apply to broad ranges of products rather to specific products.
3- To elaborate, where they are necessary, specific product standards in a coherent way with the horizontal standards.

This work needs an efficient co-ordination to avoid overlapping and duplication of standards.

III CENELEC TECHNICAL COMMITTEE TC31

The standardisation work for electrical equipment and installation in potentially explosive atmospheres is devolved to the technical committee TC 31 and some specific sub-committees.

The scope of TC31 is the following:
To standardize the general requirements for the construction and testing of electrical apparatus for potentially explosive atmospheres and the specific requirements for the construction and testing of electrical apparatus, type of protection "o" (oil immersed) and type of protection "q" (powder filled) and types with protection for use in the presence of combustible dusts, and to co-ordinate the work of the sub-committees dealing with the standardization of specific requirements for other individual types of protection.

The specific sub-committees are :

SC 31-1:	installations rules (for potentially gas explosive atmospheres)
SC 31-2:	flameproof enclosures "d"
SC 31-3	intrinsically safe apparatus and systems "i"
SC 31-4:	increased safety "e"
SC 31-5:	apparatus type of protection "n"
SC 31-7:	pressurisation "p" and other techniques
SC 31-8:	electrostatic painting and finishing equipment
SC 31-9:	electrical apparatus for the detection and measurement of combustible gases to be used in industrial and commercial potentially explosive atmospheres

IV PRESENT CENELEC STANDARDS FOR EQUIPMENT USED IN POTENTIALLY EXPLOSIVE ATMOSPHERES

CENELEC is responsible for the preparation of standards of the electrical sector of the industry.
The Technical Committee 31 and its sub-committees have been working in the field of potentially explosive atmospheres for a great number of years and have produced the EN 50 014 series of standards under the old approach directive. The updated list of the standard work program is published by CS (Central Secretariat) on http://www.cenelec.org, click under function 'Search' the 'Standardization Activities' and select 'CLC/TC31' or a subcommittee as specified above. If you click on 'Technical Bodies' and select 'CLC/TC31' or a subcommittee you will find the officers, date and place of the next meeting.

First editions

These standards apply to electrical apparatus for potentially explosive atmospheres formed by flammable gas, vapours or mists. Apparatus are intended for use in mines susceptible to firedamp (group I applications) and other classified (hazardous) areas (group II applications)

The series of standards comprises the general requirements and the specific types of protection:

EN 50 014	Electrical apparatus for potentially explosive atmospheres General requirements
EN 50 015	Electrical apparatus for potentially explosive atmospheres Oil immersion 'o'
EN 50 016	Electrical apparatus for potentially explosive atmospheres Pressurised apparatus 'p'
EN 50 017	Electrical apparatus for potentially explosive atmospheres Powder filling 'q'
EN 50 018	Electrical apparatus for potentially explosive atmospheres Flameproof enclosure 'd'
EN 50 019	Electrical apparatus for potentially explosive atmospheres Increased safety 'e'
EN 50 020	Electrical apparatus for potentially explosive atmospheres Intrinsic safety 'i'
EN 50 028	Electrical apparatus for potentially explosive atmospheres Encapsulation 'm'
EN 50 039	Electrical apparatus for potentially explosive atmospheres Intrinsically safe electric systems 'i'

An apparatus shall fulfil the general requirements plus one or more types of protection.

The series were published in the three official languages (French, German and English) in 1977. Since the adoption of the series, several of the standards have been amended and have brought in operation by updating the initial directive by the Commission.

It exists also some standards for specific products such as electrostatic spraying equipment for flammable materials and cap-lamps. TC 31 has also written standards for the performances and the testing of flammable gas detectors.

Second editions

The first series of standards have been revised and published since 1993, as the second edition of standards. This second edition takes into account the interpretation sheets, the amendments of the 1st editions and some changes implemented at an international level by IEC.

To complete the publication under the "old" directive, the European Commission has developed an amending directive, the directive 97/53/EC.
It is now possible to issue certificates of conformity according the second editions.

V CENELEC WORK IN RELATION WITH 94/9/EC ATEX DIRECTIVE

The scope of the new directive is broader compared with the requirements of the present CENELEC standards, comprising the 2nd editions.

The directive introduces categories according the location where the equipment is intended for use and the nature of explosive atmosphere.
We could summarise the CENELEC work with reference to the categories defined by the directive and the area where the equipment is intended for use (zones according to the Directive 1999/92/EC based on article 137 of EC treaty):

Category M1: group I equipment, for mines, which remains functional with an explosive atmosphere present

Category M2: group I equipment, for mines, which is intended to be de-energised in the event of an explosive atmosphere

Category 1G: group II equipment for use in zones 0 flammable gas atmospheres

Category 2G: group II equipment for use in zones 1 flammable gas atmospheres

Category 3G: group II equipment for use in zones 2 flammable gas atmospheres

Category 1D: group II equipment for use in zones 20 combustible dust atmospheres

Category 2D: group II equipment for use in zones 21 combustible dust atmospheres

Category 3D: group II equipment for use in zones 22 combustible dust atmospheres

According to these categories, TC31 and its subcommittees have produced the following standards on the basis of old ones if any.

V.1 Category M1, equipment for mines endangered by firedamp

A joint working group, formed under the guidance of CENELEC TC 31 and CEN TC 305, has prepared a standard for Category M1. This standard, the EN 50303, applies to electrical and non-electrical equipment used with the presence of an explosive atmosphere.
The requirements of this standard assume:

- The required level of protection in the event of two faults occurring independently of each other. For electrical equipment this requirement is met by using Intrinsic safety "ia" or,
- The required level of protection by using two independent types of protection.

Electrical equipment shall also meet the relevant requirements of EN 50014.
This standard is harmonised.

V.2 Category 1 G

The EN 50284 contains the requirements for equipment intended for use in areas, in which the explosive atmospheres caused by flammable gases or vapours are present continuously or for long periods. It is based on the same principles as those defined in EN 50303.
Electrical equipment shall also meet the relevant requirements of EN 50014.
This standard is harmonised.

V.3 Categories M2 and 2G, 3rd editions of EN 50014 series

The second edition standards, which represent the state of the art, form the basis of the third editions. No major technical changes are needed for compliance with the essential safety requirements given in the directive. Some non-technical changes have been necessary. They have been introduced by interface document in the form of an amendment to the second edition.
The third editions comprise this interface amendment.
The status of these editions is, for the time being :

Harmonised standards

EN 50 014: 1997	Electrical apparatus for potentially explosive atmospheres General requirements + Amendments 1 and 2
EN 50 015: 1998	Electrical apparatus for potentially explosive atmospheres Oil immersion 'o'
EN 50 017: 1998	Electrical apparatus for potentially explosive atmospheres Powder filling 'q'
EN 50 018: 2000	Electrical apparatus for potentially explosive atmospheres Flameproof enclosure 'd'
EN 50 019: 2000	Electrical apparatus for potentially explosive atmospheres Increased safety 'e'

Under approval before harmonisation (amendments and/or 3rd editions)

EN 50 016	Electrical apparatus for potentially explosive atmospheres Pressurised apparatus 'p'
EN 50 020	Electrical apparatus for potentially explosive atmospheres Intrinsic safety 'i'
EN 50 028	Electrical apparatus for potentially explosive atmospheres Encapsulation 'm'
EN 50 039	Electrical apparatus for potentially explosive atmospheres Intrinsically safe electric systems 'i

V.4 Category 3G

The EN 50021:1999, gives the requirements for category 3G equipment (for zone 2). This type of protection, called type "n", comprises non-sparking equipment and the classical types of protection. The required level of safety is assumed in normal operation.
This standard is a stand-alone document.
It is a harmonised standard.

V.5 Category 1, 2 and 3 for combustible dusts

The TC 31 has also drafted standards for equipment used in potentially explosive atmospheres caused by the presence of combustible dusts.
It exists one standard, the EN 50281-1-1: 1998, for the design and construction of electrical apparatus. The protection is based on the dust tightness of the enclosure surrounding the equipment and the limitation of surface temperatures.
Another standard, the EN 50281-2-1:1998, specifies the determination of inflammation temperatures of combustible dusts.
These standards are harmonised.

Note: IEC is preparing standards applying types of protection normally used in gas explosive atmospheres (i, m, and p). These standards will be probably adopted as EN standard according parallel voting procedure.

V.6 Harmonised standards for the detection and measurement apparatus of combustible gases (or oxygen)

EN 50054: 1998	Electrical apparatus for the detection and measurement of combustibles gases General requirements and tests methods
EN 50055 : 1998	Electrical apparatus for the detection and measurement of combustibles gases Performance requirements for group I apparatus indicating up to 5%(v/v) methane in air
EN 50056 : 1998	Electrical apparatus for the detection and measurement of combustibles gases Performance requirements for group I apparatus indicating up to 100%(v/v) methane in air
EN 50057 :1998	Electrical apparatus for the detection and measurement of combustibles gases

	Performance requirements for group II apparatus indicating up to 100% lower explosive limit
EN 50058 : 1998	Electrical apparatus for the detection and measurement of combustibles gases Performance requirements for group II apparatus indicating up to 100%(v/v) gas
EN 50104 : 1998	Electrical apparatus for the detection and measurement of oxygen Performance requirements and tests methods
EN 50241-1: 1999	Specification for open path apparatus for the detection of combustible or toxic gases and vapours Part 1: General requirements and tests methods
EN 50241-2: 1999	Specification for open path apparatus for the detection of combustible or toxic gases and vapours Part 2: Performance requirements for combustible gas detectors

VI CENELEC STANDARDS FOR THE USERS OF EQUIPMENT

CENELEC provides standards for the users as well. The EN 60079-10 is related to the classification of hazardous areas caused by flammable gases and vapours, the EN 60079-14 gives information about the selection and the installation of electrical apparatus in these areas.

For combustible dusts, the EN 50281-1-2: 1998 specifies the requirements for the selection, the installation and maintenance of electrical equipment for use in the presence of combustible dusts. A draft standard, the prEN 500281-3, tells about the classification of hazardous areas caused by flammable dusts. This draft has been adopted according the Unique Acceptance Procedure (UAP) and will probably be issued at the beginning of 2002.

VII COOPERATION WITH IEC

In September 1996, IEC agreed with CENELEC on the co-ordinated development of new standards in order to increase the efficiency in preparing standards, called the Dresden agreement.
To avoid duplication of the work, the standardisation shall be done only one time by only one organisation.
This agreement introduces the parallel voting procedure in IEC and CENELEC. This means that the same document is submitted simultaneously to IEC (in order to have an international standard) and to CENELEC (in order to have a European standard). After voting IEC and CENELEC standards will be published ideally at the same time and identical. But nevertheless, European national committees could formulate a different vote in IEC and in CENELEC.
If members of CENELEC identify a need for a European standard they shall inform IEC in order to start the work at IEC level. CENELEC members could also start the work in CENELEC Technical committees. In this case, when the CENELEC draft arrives at the approval stage, it is proposed to the IEC as an international standard draft.
In the area of explosive atmospheres this has worked well. Technical progress has been made in both sets of Standards over the years and where full agreement could not be reached alternative test methods or requirements were included in the IEC standards.

The introduction of the ATEX Directive, which is a legal document, required a change in philosophy regarding European Standards. It was decided by CENELEC to put a pause, for a short period, on the parallel voting procedure to allow the TC31 Committee to bring forward suitable Harmonised Standards under the Directive.

As we have now nearly all of them, this procedure has been reintroduced this year. However, this procedure foresees the assessmentof IEC drafts in accordance with the Essential Safety Requirements (ESR) of the Directive 94/9/EC.

The ATEX directive is a legal document and takes precedence over any Harmonised Standards. The experts have to know this fact when writing a standard. It is up to the European experts to bring the different concepts and ideas into the IEC Maintenance Teams. It has always been a two way process and should continue in future years to that measure.
With the development of IEC for Certification to Standards for Electrical Equipment for Explosive Atmospheres (IEC Ex Scheme) it is essential to continue the joint development work in order to have EN standards very close to IEC standards.

VIII ROLE OF CENELEC TC31 IN THE FUTURE

Tendency in industry go just one direction: the global market and the abolishment of trade barriers. This requires the availability of globally harmonised standards and rules to avoid inconsistencies of the increasing global trade. It is easy to understand that the provision of just one system for the design, construction and use of explosion protected electrical apparatus incorporates benefits for manufacturers, users and finally the consumers.

The CENELEC TC31 experts are globally recognised. The future role of this TC will be the co-ordination of our standardisation activities in the IEC Maintenance Teams in order to provide their experience to other experts and to articulate the European interest.

It is very important to keep influence on the development processes. The sophisticated European system in this industry field would react very sensitively if the future international standards and rules raise conflicts. Insofar the involvement of European experts is essential to avoid inefficiency by implementing the necessary globally harmonised rules.

We will enjoy sooner or later CENELEC standards which do not contain any National Difference to the IEC standards. The well known series EN 50014 will be superseded by the series EN 60079-0. This big step is to compare with the first edition of the CENELEC standards 1977 superseding national French, British, German, ... standards. Together with the new option of a Zone classification in addition to the Division system in North America, time is come to agree on an International System of Standards and Certification (see Annex 1, Non-paper for the purpose to discuss this issue in Europe). In a consequence our European TC31 needs more than ever persons who see the need of European activities and who share the vision of one global approach concerning design, engineering, installation and use of electrical apparatus for explosive gas atmospheres on the excellent European safety level.

ANNEX 1: *International development in certification of explosion protected electrical equipment*

General aspects

The certification of products which are special designed and manufactured to avoid ignition hazards in chemical and petroleum industry is required in many countries. National laws and regulations emphasize the need of domestically recognized notified bodies. This situation makes it very difficult to open markets for free trade of explosion protected electrical equipment which is, considering recent development, against the interest of industry.

Users in the chemical and petroleum industry act more and more global with a uniformed engineering of their plants

- to earn savings of engineering, installation and maintenance costs
- to buy the equipment in a larger number and to get a better price per piece
- to have benefit from the competition under manufacturers.

Barriers against this tendency are domestic rules and regulations which require special engineering from country to country.

Manufacturers want to sell and manufacture their products without additional national certification if the prototype is tested once. In other fields of products (e.g. medical devices) mutual recognition agreements (MRAs) help to abolish such trade barriers by recognizing the specific national way 'all in one' to allow the market access for this kind of the products. For explosion protected electrical equipment this 'all in one recognition' seems to run in many conflicts and needs tremendous long time without guaranty of success. Numerous MRAs are necessary to cover the interesting markets in order to satisfy the interests of the manufacturers which requires many resources to manage such a global system of MRAs.

Aspects to modify the existing situation

The users and manufacturers complain about the present situation and require to harmonize national regulations. Supposing

- The use of the relevant IEC standards (written down by best recognized experts of the world) and approved by the ATEX-consultant as EN standard

and supposing

- the influence of the national authorities on the rules of a global certification scheme

it could be considered by the European Commission to step in a global approach without running in the risk to loose control on the safety level in the European Union. This makes sense especially for the explosion protected electrical equipment because of the parallel voting and zero difference between IEC and CENELEC.

The Existing European scheme

The European scheme started in 1976 as the group of 'Heads of Test Laboratories (HOTL)' and is established now as the Ex Notified Body Group (ExNBG). Reflecting the existing ATEX system the following three key elements are needed as a guideline for the 'Global-ATEX-system':

- a procedure to recognize a standard as applicable because it covers the ESRs of the Diective 94/9/EC
- a procedure for a product oriented production audit in the factory, conducted by an expert for quality management systems **and** a technical expert who is familiar with the product
- a notification procedure to recognize certification bodies and test laboratories.

Possible Conditions for a global scheme – reflecting IECExScheme

Recognizing certificates from a global scheme by the EU or a comparable governmental authority, benefits for the safety level should be felt. The genesis of the first global certification scheme (IECExScheme) happened under the strong influence of European experts. Therefore the above mentioned key elements are to find in the rules, enriched by the experience from the ExNB scheme. So it is required

- to implement the relevant IEC standards with zero difference as a national standard
- to run the scheme with detailed rules (documents IECEx 01, 02) governed by the national committees
- to run an accreditation procedure with notified technical experts for certification bodies and laboratories under the rules of ILAC (ISO/IEC 17025:1999, ISO Guide 65) and with a final vote by the national committees about the acceptance of the audit results
- to endorse an IECEx certificate of conformity only if a detailed evaluation record is compiled in a clause by clause basis along the standard and only if a production audit on site focussed on the product (in analogy to the ATEX production audit guidelines) is conducted by a technical expert
- to form a board of appeal for managing and solving appeal cases in an acceptable time.

Conclusion

There is a need for making a step ahead in the field of explosion protected electrical equipment to a multilateral scheme. An important condition is that there is no critical impact on the existing ExNB group. EU needs the group because they are exclusively permitted to perform product evaluations in accordance to the ESRs of the Directive 94/9/EC without addressing a standard. The non-electrical equipment category 1 is to be certified by this group as well, based on CEN standards.

So it could be a good idea

- to see the relevant IEC/EN standards for electrical equipment as a hundred percent match of the Directive 94/9/EC
- to see the IECExScheme as a hundred percent match of the requirements for the notification procedure of Notified Bodies in accordance to the Directive 94/9/EC, considering the strong rules.

To become involved in the evolution of the IECExScheme the rules could foresee an official status (e.g. an advisory committee) of the representatives of the National Authorities. This has to be discussed with the IEC CAB which is very open for such an approach. Until this is implemented, the EU Commission, OSHA and similar authorities can send observers (e.g. EU the ATEX consultant) to the annual meetings,.

In this context it is to remember the situation around 1975 in Europe when the first 'Old Approach Directive 76/117/EEC' made it possible that BASEEFA certificates got the same status in Germany like BVS or PTB certificates. This was a big step for Europe at that time. To get control on global acting schemes seems to be a good reason to join in an early stage: to have opportunity to design the scheme and **to set the basic conditions before others do it.**